Auditory vs. Visual Social Distraction: No Differential Effect In Problem Solving

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Distractions from attention to the task at hand are inevitable. In situations where the task or intended point of attention is not engaging, certain types of distraction can even be welcome. Selective attention to a task involving cognitive function has been the subject of much research, and task-irrelevant stimuli present in the environment is seen to cause significant distraction effects on tasks involving rehearsal in short-term memory (Jones, 1999). While this conclusion is evident throughout past research and seems, in fact, almost common sense, it also raises the pertinent question of whether or not the type of distraction stimuli in itself (such as the sensory modality it appeals to, or the degree of cognitive engagement) has an effect on the degree of attention paid to the task at hand.

Although previous research by Berti and Schröger (2001) on distraction by task-irrelevant auditory and visual events in a button-press task did find an effect of both types of distraction on reaction time in the task, they found no differential effect between the two modalities of distraction (Berti & Schröger, 2001). Other studies on cross-modality distractions provide mixed support for this lack of differentiation, as people report an increased distraction from auditory information compared to visual information in interactive driving simulations (Mollenhauer, Lee, Cho, Hulse, & Dingus, 1994).

Further studies in attention are based specifically on more cognitively engaging distractions demanding increased attention, such as social communication, during another task that requires executive attention. Extending the research by Mollenhauer et al. (1994), Strayer, Drews, and Johnston (2003) conducted a study evaluating the distraction effects of hands-free cell phone conversations in simulated driving, and found an impaired reaction time to braking, decreased explicit recognition memory of billboards, and a general reduced attention to foveal information due to additional cognitive engagement of the competing auditory input. Visual
behaviour and vehicle control in driving are also found to be affected when asked to respond to math problems in a hands-free cell phone conversation (Harbluk, Ian Noy, Trbovich, & Eizenman, 2007). Aside from studies on driving, however, there is little current research considering other real-life applications of auditory and visual distraction on executive attention. Additional investigations with relevance to the ‘real world’ beyond the laboratory should also be undertaken, involving active distractions such as phone calls or instant messaging conversations that occur while studying, memorizing, or other tasks involving executive function.

This study was therefore conducted to compare the distraction effects of auditory and visual social communication in a task involving executive function such as mathematical problem solving. Based on the previous research on cell-phone distractions in simulated driving (Harbluk et al., 2007; Strayer & Johnston, 2001; Strayer et al., 2003; Mollenhauer et al., 1994), we hypothesized that an auditory distraction in the form of a phone conversation would result in an increased length of time required to complete the problem solving task compared to a visual instant messaging conversation, due to the input from competing sensory modalities in the auditory distraction condition.

**Method**

**Participants**

Sixteen undergraduate and graduate students with normal or corrected vision at the University of British Columbia (twelve female; mean age and SD = 20.56 ± 1.63 years) participated one at a time in the study for a PSYC 260 lab over the course of two hours. Eight participants were randomly assigned and run in the auditory distraction (phone) condition and eight others in the visual distraction (instant messaging, or IM) condition.

**Procedure**
In each condition, participants were given a set of ten two-digit by one-digit multiplication problems, and told to complete the task as quickly as possible while holding a casual conversation with a friend, arranging for a time and place to meet for a movie. Participants were told that they would need to be able to recall the information discussed after the task was completed. Following the task, participants were given a short questionnaire on demographics, the arrangements discussed in the distraction conversation, and their typical activity (such as IM, talking on the phone, watching television or videos, or listening to music) while studying.

A Dell XPS 12.1 inch laptop was used by the experimenter for phone and IM conversations. Participants in both conditions used a HP 15.4 inch laptop in the experiment. The mathematical problems were presented in a Microsoft Word document on the left half of the screen, and all participants entered answers using the laptop keyboard. A Windows Live Messenger instant messaging window was present on the right half of the screen for all participants, though an instant messaging (IM) conversation was held only with participants in the visual distraction condition. Similarly, although only participants in the auditory distraction condition held ‘phone’ conversations with the call function in Windows Live Messenger, all participants were also told to wear the headset with a microphone. Completion time for participants was recorded from presentation of mathematical problems with a cell phone stopwatch function until all ten problems were completed.

To analyze the data, the times recorded in minutes and seconds was converted to seconds. The mean completion times in seconds for each condition were then compared with an independent samples t-test at an alpha level of $p = 0.05$.

**Results**

Data were analyzed to assess the relative effects of auditory and visual distractions on time in problem solving completion. As displayed in Figure 1, comparison between conditions
found no significant difference between completion times \((t(14) = .07, p = .94)\), such that participants in both conditions completed the task with little difference in time.

Discussion

Inconsistent with our hypothesis that auditory distraction would result in increased completion time compared to visual distraction, no difference between the two modalities of distraction was found. These results instead support the previous findings of no differential effect of sensory modality in distraction, as reported by Berti and Schröger (2001). This implies that while an effect of distraction does seem to occur by cognitively engaging participants, there is little difference between the two modalities in terms of the degree of distraction that occurs.

However, there are several weaknesses in the experimental design that may have had an effect on these results, particularly evident in issues encountered while conducting the experiment.

We observed that not all participants discussed the same topics of conversation while communicating with the experimenter, particularly in the visual distraction condition. While only one experimenter conducted the phone call conversations, two different experimenters with two different conversation styles and rapidity of responses ran the online conversation. While a ‘script’ had initially been prepared beforehand, the natural progression of the conversations with participants caused this control to be discarded to maintain a more realistic environment. It was therefore difficult to actively engage participants while maintaining a strictly controlled ‘manipulation’ of attention, since different participants not only think differently, but have different conversational habits and place varying degrees of importance on the social implications of certain responses made within a conversation. Future studies attempting to control for these weaknesses in experimental design could consider including an additional control condition as a baseline against which the experimental conditions can be compared in order to obtain more reliable results. In addition, the effects of cross-modality distraction could perhaps be made more

Comment [m7]: Make sure to report your stats correctly. In the case of a t-test, you have a t-value, the degrees of freedom in parentheses, and then a p-value. P-values less than .05 mean that you have a statistically significant difference between your conditions. Also make reference here to a figure if you included one. ***Remember, it is not good or bad if your results are significant or not. We just want you to state the results and then try to tell us what they mean in terms of the theoretical question you are addressing.

Comment [m8]: Good discussions begin with a simple summary of your results.

Comment [m9]: Then try to relate your findings to prior work.

Comment [m10]: Here, a non-significant effect was found, but the student was still able to talk about what this means for the way cognition works. So null findings can still be interesting! Actually, the student could have even extended this section. Don’t be afraid to put your own ideas out there about what your findings mean. And try to incorporate some other findings so that we can understand your findings in the context of what is already known in that area of research.

Comment [m11]: Here the student outlines some potential confounds in the design of the experiment – that is, variables that could have had an influence aside from their manipulation of attention and could have affected their results. ****Remember, a study can have a weakness that is not a confound – e.g., not having a representative sample is a weakness, but is not a confound, because it is likely that it would influence each of your conditions equally. A confound usually means that your specific manipulation is not the only difference between your conditions. In this case, they manipulated distraction type, but they noted that they had 2 different experimenters controlling the online distraction, but only 1 experimenter controlling the auditory distraction.
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salient with a faster, more stimulus-driven task, as distraction effects are more disruptive in such tasks compared to slower, semantic-based tasks, as seen in previous work on instant messaging (Czerwinski, Cutrell, & Horvitz, 2000).

A further consideration with this particular experiment is the question of how the conversation carried out in the two conditions is represented in the brain. That is, while participants in the auditory condition could simply hear and process the questions asked in order to promptly respond, participants in the visual condition were able to read the questions more than once before responding in due time. While this logic seems to support our original hypothesis, the results obtained could also be explained when considering the possibility that the perception of the words may require translation from the physical sight of the word to an imaged sound representation in the mind prior to analysis of meaning and formation of an appropriate response. This would require additional processing beyond the differences between auditory and visual stimuli. Since the focus of this experiment remained solely on the differential effects between cognitively engaging auditory and visual stimuli as distractions, future experiments should be considered to further investigate the processing of language across modalities in the context of distraction in executive attention.

In this experiment, it was found that no effect of modality existed in relative degree of distraction for auditory (phone) and visual (IM) cognitive distractions from a task of executive function, suggesting that input from competing sensory modalities does not affect the amount of distraction that occurs. However, further research is required for more generalizable and conclusive results, and in order to investigate the cross-modality language processes behind these socially interactive distractions.
References


Figure Captions

Figure 1. Comparison of mean time taken to complete set of mathematical problems between the auditory distraction condition and the visual distraction condition. Error bars represent standard error of the mean for the respective conditions.

Comment [m15]: Figure caption nicely describes what we see in the figure.
Auditory vs. Visual

Type of Distraction

Mean time for task completion (s)

Auditory (phone)  Visual (IM)

0  50  100  150  200  250

Mean time for task completion (s)